

**REMARKS**

Claim 25 is currently being amended to further particularly point out and distinctly claim what Applicant regards as the inventive subject matter. Basis for the amendment can be found throughout the specification, in particularly on page 3, lines 29-32 and Fig. 1.

These amendments do not introduce new matter within the meaning of 35 U.S.C. §132. Accordingly, entry of the amendments prior to examination is respectfully requested.

**Interview**

Applicant kindly thanks the Examiner for discussing this case over the telephone on July 5, 2006. As previously discussed, independent claim 25 has been amended to include a limitation indicating that the deactivator is added to the liquid reaction medium soluble polymer after being withdrawn from the liquid reaction medium.

Accordingly, Applicant believes claims 25-48 are patentably distinguishable.

**1. Rejection of Claims 25-48 Under 35 U.S.C. §102(b)**

The Office Action states that claims 25-48 are rejected under 35 U.S.C. §102(b) as being anticipated by Hwang, et al. (U.S. Patent 4,634,744). In particular, the Office Action states,

Hwang et al. disclose a method for continuously homopolymerizing ethylene or interpolymerizing ethylene

with one or more 1-olefin in a reactor in the presence of a catalyst which comprises a transition metal derivative, wherein the polymer so formed is discharged from the reactor in a molten solution stream and wherein a deactivator comprising ethoxylated hydrocarbylamines of the formula of  $R'_{3-n}N[(OCH_2CH_2)_mOH]_n$  is added to the molten polymer solution to deactivate the Ziegler-Natta catalyst (abstract; claim 1). Hwang et al. further disclose that "The polymerization is carried out in a reactor of any convenient type, including stirred autoclave reactors, tubular reactors, or in a series of reactors of either the autoclave or tubular type. The polymerization conditions are selected such that the reaction mixing of monomer, comonomer (if present), and product polymer is homogeneous, i.e. the polymer is soluble in the reaction mixture" (col. 2, lines 59-66) and "liquid diluents, such as liquid alkanes, may be present" (col. 2, lines 67-68). Hwang et al. also disclose that "the selected catalyst deactivator is injected directly into the actively polymerizing molten polymer solution stream at a point in the reactor prior to discharge of the stream from the reactor and prior to degassing of the polymer stream" (col. 3, lines 22-26). Thus, the present claims are anticipated by the disclosure of Hwang et al.

#### RESPONSE

Applicant traverses the rejection of claims 25-48.

For a reference to anticipate an invention, all of the elements of that invention must be present in the reference. The test for anticipation under section 102 is whether each and every element as set forth in the claims is found, either expressly or inherently, in a single prior art reference. *Verdegaal Bros. V. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must also be arranged as required by the claim. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990).

Applicant respectfully believes U.S. Patent 4,634,744 (referred to herein as Hwang, et al.) fails to disclose, teach, or suggest, "A liquid-phase process for polymerizing at least one  $\alpha$ -olefin of formula  $\text{CH}_2=\text{CHR}$ , wherein R is H or a  $\text{C}_1\text{-C}_6$  alkyl radical, comprising the steps of:

- continuously polymerizing in a liquid reaction medium the  $\alpha$ -olefin with a catalyst system comprising at least one transition metal compound;

- continuously withdrawing a solution of liquid reaction medium soluble polymer; and

- after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than  $150^\circ\text{C}$ , wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{\text{OH}}$ ) of the organic deactivator is between 20 and 100."

In particular, Applicant respectfully believes Hwang, et al. fails to disclose, teach, or suggest a liquid-phase process which continuously withdraws a solution of liquid reaction medium soluble polymer, and after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than  $150^\circ\text{C}$ , wherein a ratio of the molecular weight (MW) of

the organic deactivator to the hydroxy group ( $\text{noH}$ ) of the organic deactivator is between 20 and 100, as recited by currently pending independent claim 25.

In fact, the Examiner has correctly noted Hwang, et al. discloses "the selected catalyst deactivator is injected directly into the actively polymerizing molten polymer solution stream at a point in the reactor prior to discharge of the stream from the reactor and prior to degassing of the polymer stream." See col. 3, lines 22-26 (Emphasis added).

Claims 26-48 depend directly or indirectly from independent claim 25, and necessarily include all of the limitations of the claim(s) from which they depend.

In light of the above, claims 25-48 are therefore believed to be patentable over Hwang, et al. Accordingly, reconsideration and withdrawal of the rejection is requested.

## **2. Rejection of Claims 25-48 Under 35 U.S.C. §103(a)**

The Office Action states that claims 25-48 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takayuki, et al. (U.S. Patent 4,551,509) in view of Naga, et al. (U.S. Patent 6,281,302). In particular, the Office Action states,

Takayuki et al. disclose a process for producing ethylene polymer or ethylene copolymer, comprising the steps of (a) continuously polymerizing ethylene or ethylene and an  $\alpha$ -olefin in a reaction mixture at a pressure of at least 300  $\text{kg/cm}^2$  and a temperature of at least 130°C in the presence of a catalyst composed of a compound of a transition metal of groups IVa and VIa of the Periodic Table and an organometallic compound of a metal of Groups I to III of

the Periodic Table and (b) adding a polyalkylene glycol to the reaction mixture to deactivate the catalyst (claim 1).

The difference between the present claim and the disclosure of Takayuki et al. is the requirement of a liquid phase polymerization process instead of a gas phase polymerization process.

Naga et al. disclose a process for olefin polymerization in the presence of a catalyst comprising a transition metal compound of Group IV of the Periodic Table and an organometallic compound of metal of Group I, II or XIII of the Periodic Table (claim 1). Naga et al. further disclose that "slurry polymerization or solvent polymerization using an inert hydrocarbon solvent (e.g. propane, pentane, hexane, heptane, octane), liquid phase polymerization using no solvent (bulk polymerization) or gas phase polymerization can also be applied" (col. 9, lines 22-28). Thus, in view of the method to utilize the catalyst, gas phase polymerization is equivalence to and exchangeable with liquid phase polymerization. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize liquid phase polymerization in the disclosure of Takayuki et al. and thereby obtain the present invention.

#### RESPONSE

Applicant traverses the rejection of claims 25-48.

The U.S. Supreme Court in *Graham v. John Deere Co.*, 148 U.S.P.Q. 459 (1966) held that non-obviousness was determined under § 103 by (1) determining the scope and content of the prior art; (2) ascertaining the differences between the prior art and the claims at issue; (3) resolving the level of ordinary skill in the art; and, (4) inquiring as to any objective evidence of non-obviousness.

To establish a *prima facie* case of obviousness, the Examiner must establish: (1) that some suggestion or motivation to modify the references exists; (2) a reasonable expectation of success; and (3) that the prior art references teach or suggest all the claim

limitations. Amgen, Inc. v. Chugai Pharm. Co., 18 USPQ2d 1016, 1023 (Fed. Cir. 1991); In re Fine, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 USPQ 494, 496 (C.C.P.A. 1970).

Further, the Examiner needs to show basis for combining the references to properly set forth a *prima facie* case of obviousness. The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper; In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998). The level of skill in the art cannot be relied upon to provide the suggestion to combine references. Al-Site Corp. v. VSI Int'l Inc., 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999). (Emphasis added) See MPEP 2143.01.

Takayuki, et al. relates to a gas-phase process for producing ethylene polymers or ethylene copolymers comprising the steps of: (a) continuously polymerizing ethylene or ethylene and an alpha-olefin in a reaction mixture at a pressure of at least 300 kg/cm<sup>2</sup> and a temperature of at least 130°C in the presence of a catalyst composed of a compound of a transition metal of groups IVa to VIa of the Periodic Table and an organometallic compound of a metal of groups I to III of the Periodic Table; and (b) adding a polyalkylene glycol to the reaction mixture to deactivate the catalyst. See col. 2, lines 2 - 11 (Emphasis added)

Naga, et al. relates to a solid catalyst component for olefin polymerization which exhibits a high activity and can produce an

olefin polymer containing low molecular weight polymers and/or low crystalline polymers produced in very small amount. See col. 2, lines 23-28.

In contrast, Applicant has invented a liquid-phase process useful for polymerizing  $\alpha$ -olefins wherein the catalyst residues are deactivated without causing any worsening in the final properties of the obtained polymer and improving the recovery of the monomer in the recovery section, as well as preventing pre-mature deactivation of the catalyst system. This is attributed to the currently claimed process in which a solution of liquid reaction medium soluble polymer is continuously withdrawn, and after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than 150°C, wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{OH}$ ) of the organic deactivator is between 20 and 100. See page 2, line 23 - page 4, line 3 of Applicant's specification.

Accordingly, Applicant respectfully believes U.S. Patent 4,551,509 (referred to herein as Takayuki, et al.) fails to disclose, teach, or suggest, "A liquid-phase process for polymerizing at least one  $\alpha$ -olefin of formula  $CH_2=CHR$ , wherein R is H or a  $C_1$ - $C_6$  alkyl radical, comprising the steps of:

- continuously polymerizing in a liquid reaction medium the  $\alpha$ -olefin with a catalyst system comprising at least one transition

metal compound;

- continuously withdrawing a solution of liquid reaction medium soluble polymer; and

- after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than 150°C, wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{OH}$ ) of the organic deactivator is between 20 and 100."

In particular, Applicant respectfully believes Takayuki, et al. fails to disclose, teach, or suggest a liquid-phase process which continuously withdraws a solution of liquid reaction medium soluble polymer, and after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than 150°C, wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{OH}$ ) of the organic deactivator is between 20 and 100, as recited by currently pending independent claim 25.

In fact, Takayuki, et al. discloses a completely different process than Applicant is currently claiming. Takayuki, et al. discloses, "At the completion of the reaction, at least one kind of polyalkylene glycol is added to the reaction mixture in a quantity



sufficient to deactivate the ionic polymerization catalyst in this invention." See col. 2, lines 22-25 (Emphasis added).

Thus, Takayuki, et al. discloses adding a polyalkylene glycol directly to the reaction mixture, whereas Applicant is currently claiming adding an organic deactivator to a solution of liquid reaction medium soluble polymer after being withdrawn from a liquid reaction medium.

Moreover, Applicant respectfully believes Takayuki, et al. fails to disclose, teach, or suggest a liquid-phase polymerization process which continuously withdraws a solution of liquid reaction medium soluble polymer, as recited by the currently pending claims. In fact, the Examiner has noted Takayuki, et al. relates to a gas-phase polymerization process. In this regard, the Examiner is relying on a combination of Takayuki, et al. and Naga, et al. to exchange the disclosure of Takayuki, et al. relating to a gas-phase polymerization process with a liquid-phase polymerization process. However, Applicant respectfully traverses the Examiner's combination of Takayuki, et al. and Naga, et al. to modify the disclosure of Takayuki, et al.

In particular, Naga, et al., not Takayuki, et al., merely generally discusses the possible use of liquid-phase polymerization as a possible process method for use with the solid catalyst compounds disclosed within Naga, et al. In this regard, there is no suggestion or motivation to modify Takayuki, et al. to use a liquid-phase polymerization process in lieu of a gas-phase polymerization

process, nor is there an appropriate nexus between the disclosure of Naga, et al. and the disclosure of Takayuki, et al. to modify Takayuki, et al. to use a liquid-phase process so that one skilled in the art would have a reasonable expectation of success given the vast technical differences between both references, along with the fact that both Takayuki, et al. and Naga, et al. both relate to solving different technical problems within the polymer field, as discussed *supra*.

Thus, in addition to not disclosing, teaching, or suggesting a liquid-phase process which continuously withdraws a solution of liquid reaction medium soluble polymer and then adding a deactivator to the solution of liquid reaction medium soluble polymer, Takayuki, et al. does not disclose, teach, or suggest continuously polymerizing in a liquid reaction medium the  $\alpha$ -olefin with a catalyst system comprising at least one transition metal compound.

Accordingly, given the vast differences between the problems which Takayuki, et al. and Naga, et al. aim to solve, and the lack of suggestion to combine the references, Applicant respectfully traverses the Examiners combination of Takayuki, et al. and Naga, et al. See MPEP § 2141.01(a) and 2143.01.

Additionally, there is no motivation or suggestion to modify Takayuki, et al. alone, or in view of Naga, et al., to arrive at the currently claimed subject matter. Nor, as discussed *supra* in part, would there be a reasonable expectation of success given the vast differences between the disclosure of Takayuki, et al. and the

currently claimed subject matter.

As briefly discussed *supra*, Naga, et al. does not remedy the deficiencies of Takayuki, et al. In addition to the arguments outlined *supra*, Naga, et al. does not disclose, teach, or suggest, "A liquid-phase process for polymerizing at least one  $\alpha$ -olefin of formula  $\text{CH}_2=\text{CHR}$ , wherein R is H or a  $\text{C}_1\text{-C}_6$  alkyl radical, comprising the steps of:

- continuously polymerizing in a liquid reaction medium the  $\alpha$ -olefin with a catalyst system comprising at least one transition metal compound;

- continuously withdrawing a solution of liquid reaction medium soluble polymer; and

- after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than  $150^\circ\text{C}$ , wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{\text{OH}}$ ) of the organic deactivator is between 20 and 100."

In particular, Naga, et al. does not disclose, teach, or suggest, a liquid-phase process which continuously withdraws a solution of liquid reaction medium soluble polymer, and after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least

one hydroxy group, and a boiling point higher than 150°C, wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{OH}$ ) of the organic deactivator is between 20 and 100, as recited by currently pending independent claim 25.

Accordingly, there is no motivation or suggestion to modify Naga, et al. alone, or in view of Takayuki, et al., to arrive at the currently claimed subject matter. Nor, as discussed *supra* in part, would there be a reasonable expectation of success given the vast differences between the disclosure of Naga, et al. and the currently claimed subject matter.

Claims 26-48 depend directly or indirectly from independent claim 25, and necessarily include all of the limitations of the claim(s) from which they depend.

In light of the above, claims 25-48 are therefore believed to be patentable over Takayuki, et al. in view of Naga, et al. Accordingly, reconsideration and withdrawal of the rejection is requested.


#### CONCLUSION

Based upon the above remarks, the presently claimed subject matter is believed to be novel and patentably distinguishable over the references of record. The Examiner is therefore respectfully requested to reconsider and withdraw all rejections and allow all pending claims 25-48. Favorable action with an early allowance of the claims pending in this application is earnestly solicited.

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The Examiner is welcomed to telephone the undersigned  
practioner with any questions or comments.

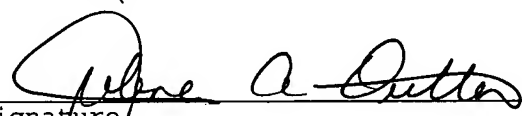
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ATTACHMENT A

Claims 1 - 24: (Cancelled)

25. (Currently amended): A liquid-phase process for polymerizing at least one  $\alpha$ -olefin of formula  $\text{CH}_2=\text{CHR}$ , wherein R is H or a  $\text{C}_1\text{-C}_6$  alkyl radical, comprising the steps of:

- continuously polymerizing in a liquid reaction medium the  $\alpha$ -olefin with a catalyst system comprising at least one transition metal compound;
- continuously withdrawing a solution of liquid reaction medium soluble polymer; and
- after the solution of liquid reaction medium soluble polymer is withdrawn, mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with an organic deactivator having at least one hydroxy group, and a boiling point higher than  $150^\circ\text{C}$ , wherein a ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{\text{OH}}$ ) of the organic deactivator is between 20 and 100.

26. (Previously presented): The process according to claim 25, wherein the  $\alpha$ -olefin is butene-1.

27. (Previously presented): The process according to claim 26, wherein a solution of polybutene-1 is in the liquid reaction medium and is continuously obtained.

28. (Previously presented): The process according to claim 27, wherein the liquid reaction medium is liquid butene-1.

29. (Previously presented): The process according to claim 25, wherein the  $\alpha$ -olefin is continuously polymerizing in the liquid reaction medium at a temperature from 65 to 85°C.

30. (Previously presented): The process according to claim 25, wherein the  $\alpha$ -olefin is continuously polymerizing in the liquid reaction medium at a pressure between 8 and 40 bar.

31. (Previously presented): The process according to claim 25, wherein the  $\alpha$ -olefin is continuously polymerizing in the liquid reaction medium in at least one continuously stirred tank reactor.

32. (Previously presented): The process according to claim 28, wherein a concentration of polybutene-1 in butene-1 is kept to a value of less than 35% by weight in the liquid reaction medium.

33. (Previously presented): The process according to claim 32, wherein the concentration of polybutene-1 in butene-1 is between 10 and 30% by weight in the liquid reaction medium.

34. (Previously presented): The process according to claim 25, wherein butene-1 is polymerized with up to 20% by weight based on butene-1, of an  $\alpha$ -olefin other than butene-1.

35. (Previously presented): The process according to claim

25, wherein the ratio of the molecular weight (MW) of the organic deactivator to the hydroxy group ( $n_{OH}$ ) of the organic deactivator is between 30 and 70.

36. (Previously presented): The process according to claim 25, wherein the organic deactivator is selected from propylene glycol, dipropylene glycol, glycerol, diethylene glycol, and butandiol.

37. (Previously presented): The process according to claim 25, wherein the catalyst system is a Ziegler-Natta catalyst comprising a Ti-containing compound as a solid catalyst component and an Aluminum alkyl compound as an activator.

38. (Previously presented): The process according to claim 37, wherein a molar ratio of the organic deactivator/(Ti+Al) is higher than  $2/n_{OH}$ .

39. (Previously presented): The process according to claim 38, wherein the molar ratio is between  $3/n_{OH}$  and  $6/n_{OH}$ .

40. (Previously presented): The process according to claim 25, wherein mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with the organic deactivator is carried out in one or more mixing tanks placed in series.

41. (Previously presented): The process according to claim 25, wherein mixing in one or more mixing stages the solution of liquid reaction medium soluble polymer with the organic deactivator is carried out in a single deactivation apparatus further comprising a sequence of mixing stages.



42. (Previously presented): The process according to claim 41, wherein the single deactivation apparatus further comprises a stirring shaft comprising between 2 and 20 impellers.

43. (Previously presented): The process according to claim 42, wherein the mixing stages are formed along the stirring shaft by rotating the impellers.

44. (Previously presented): The process according to claim 42, wherein the impellers comprise radial blades fixed at the stirring shaft, the radial blades causing a radial flow inside each mixing stage.

45. (Previously presented): The process according to claim 41, wherein the solution of liquid reaction medium soluble polymer and the organic deactivator are continuously fed at an inlet of the deactivation apparatus and flow slowly through the sequence of mixing stages.

46. (Previously presented): The process according to claim 28, further comprising passing a solution of polybutene-1 in butene-1 to a separation step, wherein the polybutene-1 is separated from unreacted monomer, which is recovered and re-circulated.

47. (Previously presented): The process according to claim 46, wherein the separation step is carried out by melt devolatilization by means of one or more volatilization chambers operating at a decreasing pressure.

48. (Previously presented): The process according to claim 34, wherein butene-1 is polymerized with 0.5 to 10% by weight based on butene-1, of an  $\alpha$ -olefin other than butene-1.